

REMARKS

The Examiner is thanked for the courtesy extended during an interview in the Examiner's office on June 15, 2004. Present at the interview were the Examiner, Dr. Baker, and the undersigned attorney for applicant. While no agreement was reached with respect to the allowance of this application, an agreement was reached with respect to the amendments applicants agreed to make herein.

By way of the present communication applicants have amended claims 1 and 8 by limiting the multifaceted nanotubes to those that are comprised of platelets aligned substantially parallel to the growth axis of the nanotubes.

Applicants acknowledge that claims 1-7 have been allowed.

First Rejection Under 35 USC 103(a)

Claims 8, 9, 13, and 14 have been rejected under 35 USC 103(a) as being obvious over Moy et al. (US 6,143,689).

Examiner's Position

It is the Examiner's position that Moy et al. teaches making carbon nanotubes from CO and Fe on Mg. The Examiner believes that while not describing the product as multifaceted he believes that any imperfection in the cylinder of Moy et al. would be a "facet". The Examiner also states that Moy et al. does not exemplify using H₂ and CO, but that choosing them together is an obvious expedient to optimize fiber formation by suppressing graphite, as hydrogen is well known to do in nanotube synthesis.

Applicants' Position

It is applicants' position that an imperfection would not change a cylindrical carbon nanotube into a multifaceted nanotube. Only very specific catalytic metals and conditions, which must include hydrogen, will lead to multifaceted graphitic nanotubes. Applicants refer to the previously submitted herewith a Declaration under 35 USC 1.132 containing experiments that evidence that Fe will not produce multifaceted graphitic

nanotubes and that only when hydrogen is present with carbon monoxide, and with Co or Ni being the catalytic metal, will multifaceted graphitic nanotubes be produced.

The Addendum to the Declaration under 35 USC 1.132 shows a rough representation of the types of nanostructures produced by the experiments of this Declaration. Fe/MgO with carbon monoxide only will produce a structure similar to that represented by the first figure that shows a shell like structure. It will not produce a multifaceted nanotubular structure. When hydrogen is used in combination with carbon monoxide, the Fe/MgO catalyst will produce a "platelet" like structure that is also represented in the Addendum hereto. Only when the catalyst is Co/MgO or Ni/MgO will a multifaceted nanotubular structure be produced with carbon monoxide and hydrogen.

Applicant also refers to newly submitted article entitled "Promotional Effect of Carbon Monoxide on the Decomposition of Ethylene Over an Iron Catalyst"; Rodriguez et al.; Journal of Catalysis 144, 93-108 (1993). Table 2 of this article evidences that it is unexpected that Co and Ni would produce graphite nanofibers using CO as the carbon-containing gas in combination with hydrogen.

Further, Moy et al. relates to a method for increasing the production of carbon "fibrils" by requiring that a carboxylate or phenolate compound be incorporated into the "fibril" producing catalyst. The instantly claimed invention does not require the use of a carboxylate or phenolate compound during the production of their graphitic multifaceted nanotubes.

Therefore, applicants request that the Examiner reconsider and withdraw this rejection.

Second Rejection Under 35 USC 103(a)

Claim 10 have been rejected under 35 USC 103(a) as being unpatentable over Moy et al. as applied to claims 8, 9, 13 and 14 above, and further in view of Rodriguez '951.

Examiner's Position

The Examiner notes that Moy et al. does not teach the use of Co, but that Rodriguez does as an equivalent for Fe.

Applicants' Position

It is applicants' position that Co and Fe are not equivalents for the purpose of producing multifaceted graphitic nanotubes. The data set forth in the accompanying Declaration under 35 USC 1.132 of R. Terry K. Baker show that Fe is not capable of producing multifaceted nanotubes, but that only Co and Ni are.

Also, applicants submit with this communication a second Declaration under 35 USC 1.132. This second declaration is from Dr. Ralph T. Yang, a Dwight F. Benton Professor of Chemical Engineering at the University of Michigan at Ann Arbor, Michigan. Dr. Yang is a recognized expert in the carbon art and has received various awards, has published two books, and more than 330 publications and is an inventor on about 20 patents. It is Dr. Yang's opinion that there is no suggestion in either Moy et al. or Rodriguez et al., alone or in combination for producing multifaceted graphitic nanotubes as instantly claimed.

The Rodriguez et al. reference teaching the storage of hydrogen in graphitic nanostructures and mentions many types of carbon-containing gases and catalytic metals, but there is no suggestion that multifaceted nanotubes can be produced from a CO and hydrogen atmosphere using Co or Ni with a Group II metal oxide, preferably MgO.

Therefore, applicants request that the Examiner reconsider and withdraw this rejection.

For the foregoing reasons it is applicants' position that the claims, as now amended, define a patentable invention over the cited art. Therefore, applicants request that this application be passed to allowance.

Respectfully submitted,

By


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